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they may become tendrils, or spines, or glandular organs; or they may be rudiments, looking back to organs of use in another form.

There is a chapter also on the nature of stipules. There are three views as to what stipules are: (1) they are appendages of the leaves (Van Tieghem, Baillon, Gray); (2) they are autonomous organs, analogous to leaves (Lindley); (3) they are an integral part of the leaf. Lubbock holds the third view. The first view he regards as untenable because stipules originate independently of leaves and often before them; the second because the stipule bundles are derived from the foliar bundles.

The book is full of illustrations and very suggestive, though it seems that there is too great a certainty as to just what everything is for.—HENRY C. COWLES.

#### An ecological text-book.

AMONG THE recent text-books for secondary schools none is so dominated by the new ecological standpoint as the book just issued by Dr. John M. Coulter. This is one of the series of "Twentieth Century Text-books," in course of publication by Messrs. D. Appleton & Co.<sup>3</sup>

It is the first of a pair of books, each representing work for half a year, but independent. The second, with the title *Plant Structures*, is to be issued shortly. It is to be dominated by morphology as the first is dominated by ecology. In the judgment of Dr. Coulter the order in which he issues the books is the proper one for presentation in an elementary course. This sequence is likely to meet with the criticism that the student, in ignorance of plant structure and without wide acquaintance with plant groups, is unable to appreciate ecological phenomena and principles. The author believes the advantages which counterbalance the disadvantages are (1) the obtaining of a true conception of plants in nature, (2) acquaintance with the large problems of plant physiognomy, and (3) the avoidance of the use of the compound microscope at the outset.

Though the physiognomy of vegetation is an interesting and perhaps most important phase of botany, it is doubtful whether at the present time the subject is well enough organized to justify its dominating an elementary course. It is still more doubtful whether it will be possible for many years to find teachers capable of presenting it. Granting the ecological aspect to be the ideal botanical course, the question is whether we are yet far enough away from the floristic or pseudo-taxonomic teaching to justify an attempt to reach so remote an ideal. The writer has already committed himself to the view that the simpler morphology and physiological topics should be first presented in an elementary course and therefore only states the pedagogical

<sup>3</sup> COULTER, J. M.: *Plant Relations*, a first book of botany. 12mo. pp. x + 264. figs. 206. New York: D. Appleton & Company, 1899.

problem. To its solution Dr. W. F. Ganong contributes interesting arguments in a book elsewhere reviewed.

Readers of *Plant Relations* will be impressed by the terse and lucid style. Though the utmost condensation has been necessary, the author has preserved a simplicity of language and has attained a degree of accuracy which leaves nothing to be desired. The book is also striking in the number and beauty of its many illustrations, of which a large part are original. Among the finest ones are those derived from Schimper's recent treatise, *Pflanzen-geographie*.

A very useful pamphlet of twenty pages, embodying suggestions to teachers for the use of the book, is designed to accompany it. It contains helpful remarks regarding the laboratory and field work which the author intends, of course, shall be prosecuted as the foundation for the study of the text.

We are sure that live school-teachers will welcome this book because it presents a new view of the plant world, valuable for instructional purposes and hitherto too much overlooked. University teachers will receive it gladly because it emphasizes one of the vital aspects of botany, and makes more effective the crusade against the cut and dried formalism of "analysis." — C. R. B.

#### Cytological technique.

INVESTIGATIONS upon the structure of protoplasm demand not only extreme skill in mechanical manipulation but also a knowledge of the principles underlying fixing, staining, and other details of microtechnique. A recent book by Dr. Alfred Fischer puts the whole subject of microtechnique upon a firmer and more philosophical basis and gives an up-to-date discussion of modern theories of protoplasmic structure.<sup>4</sup>

Part I, on fixing agents, considers in detail the solutions in common use and describes their action upon the various cell contents, as peptone, proalbumose, nucleic acid, nuclein, etc., etc. The numerous experiments with substances of known chemical composition should be of value in determining what are to be regarded as artifacts and what as structural elements of the tissue. The closing chapter on the fixation of cell contents will be found especially helpful by those engaged in cytological work.

Part II (128 pages) is devoted to staining. Both theory and practice are considered in detail. Some of the topics are as follows: The washing out of the fixing agent, and its significance in theories of staining; staining in simple staining solutions without differentiation; double staining with simple solutions; simultaneous double staining with mixed stains; impreg-

<sup>4</sup> FISCHER, ALFRED.: Fixirung, Färbung und Bau des Protoplasmas. Kritische Untersuchungen über Technik und Theorie in der neueren Zellforschung. 8vo. pp x + 362. pl. 1. figs. 21. Leipzig: Gustav Fischer. 1899. M 11.